CONFERENCE OF THE COMMITTEE ON DISARMAMENT

CCD/288
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JAPAN

Working Paper on the Question of Verification for Prohibition of Chemical and Biological Weapons

1. Chemical characteristics of nerve agents

(1) Tabun, Sarin, Soman and VX are known as typical nerve agents used for chemical weapons. All these agents are organophosphorus compounds. While Tabun which was developed in earlier stage, can be produced from yellow phosporus and through phosphorus oxychloride, Sarin, Soman and VX can be produced from yellow phosphorus and through such common intermediates as phosphorus trichloride, dimethylphosphite or methylphosphonic dichloride (or difluoride). It is pointed out in this connexion that these three agents contain methylphosphorus bond (alkyl-phosphorus bond) causing particularly strong poisonous effects on warm-blooded animals.

(2) Among the agricultural chemicals of organophosphorus family, which are widely used as insecticides or bactericides, there are some (for example, Parathion or TEPP) which can be used, due to their highly poisonous effects and depending upon their dosage, as nerve agents for weapon purposes. These agricultural chemicals of organophosphorus family can be produced from phosphorus trichloride, phosphorus oxychloride, phosphorus pentasulfide and phosphorus pentachloride.

(3) All of these organophosphorus compounds are produced from yellow phosphorus as their starting material which is then converted to phosphorus trichloride, phosphorus oxychloride, phosphorus pentasulfide or phosphorus pentachloride by chemical reactions. It is further noted that dimethylphosphite and/or methylphosphonic dichloride (or difluoride) which are the intermediates derived mainly from phosphorus trichloride, lead to the production of Sarin, Soman and VX.

2. Peaceful uses of raw materials and intermediates

(1) Yellow phosphorus is mass-produced as the material for various inorganic and organic phosphorus compounds.

(2) Phosphorus trichloride, phosphorus oxychloride, phosphorus pentasulfide and phosphorus pentachloride are produced from yellow phosphorus and are the common raw materials used widely for the production of agricultural chemicals, pharmaceuticals and dyestuffs, etc.

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(3) Dimethylphosphite is mainly produced from phosphorus trichloride and is widely used for peaceful industry as synthesizing materials for insecticides, bactericides, flame retardants, and as additives to lubricants.

(4) Methylphosphonic dichloride (or difluoride) is mainly produced from dimethylphosphite. Detailed information regarding its use for peaceful purposes is limited. However, as this agent is reported to be used as material for the preparation of phosphorus polymer, it is likely that other peaceful uses of that agent might be found in future.

3. Possible check points

As shown above, the production of nerve agents and agricultural chemicals of organophosphorus family having poisonous effects equivalent to nerve agents, requires particular kind of materials which are widely used for the production of other industrial goods.

Therefore, it should become possible to see whether or not these materials are being used for the production of chemical weapons if we can trace the flow of such materials in each State by checking the amount of their production, import and export, or the amount of their consumption for different purposes, these materials are enumerated as follows: yellow phosphorus, phosphorus trichloride, phosphorus oxychloride, phosphorus pentasulfide, phosphorus pentachloride, dimethylphosphite and methylphosphonic dichloride (or difluoride).

In so doing, it should be possible to prevent these particular materials from being diverted into the production of nerve agents or to deter improper use of highly poisonous organophosphorus agricultural chemicals as chemical warfare agents.

N.B. It is understood that our study should be pursued on new intermediates which may be discovered in future, as organophosphorus chemical industry develops.

CONFERENCE OF THE COMMITTEE ON DISARMAMENT

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ITALY

Suggestions regarding the possible convening of a group of experts to study the problem of controls over chemical weapons and the way in which such a group should function

1. In the course of the informal meeting of the CCD on 22 April 1970, devoted to the question of the prohibition of chemical and biological weapons, discussions were mainly concentrated on the problem of control over the production and stockpiling of chemical weapons.

It thus appeared to be confirmed, in the opinion of various delegations, that the establishment of an effective system of controls is still the major problem among those that the Committee will have to solve with a view to achieving an agreement for the prohibition of chemical weapons.

Moreover, the participation in that same meeting of experts from various countries gave emphasis to the fact that the problem of controls presents some aspects that are predominantly scientific and a knowledge of which is essential before the various delegations can profitably embark on discussion of a draft treaty.

2. For the purposes of such a discussion, the committee has at its disposal, at the moment, three highly valuable scientific studies: the "Report of the Secretary-General on chemical and bacteriological (biological) weapons and the effects of their possible use"; the report by the World Health Organization entitled "Health aspects of Chemical and Biological Weapons"; and the as yet unfinished report by the Stockholm International Peace Research Institute (SIPRI) "The problem of chemical and biological warfare".

Of these three documents, the first aims at giving a scientific evaluation of the effects of chemical and biological weapons and informing the Governments of the consequences of any use that might be made of them, while the second is intended specially for the public-health authorities and leaves aside the purely military aspects of the problem. Neither of these two studies goes specifically or in any depth into the question of controls.

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The SIPRI report, on the other hand, tackles all the different aspects of the problem, including that of verification, to which the whole of Volume IV is devoted.

This part of the report, although of exceptional interest and usefulness, is nevertheless of an incomplete and preliminary nature. Moreover, it was conceived with a more general purpose in view, not with the specific aim of being able to provide the Committee on Disarmament with an exhaustive technical study as a working tool.

3. The Italian Delegation accordingly believes that the above mentioned studies could be usefully supplemented by a specific study on the problem of controls of chemical weapons, which could constitute a background document for the work of the Conference. Such a study could be drawn up, as has been suggested by various Delegations, and in particular by the Japanese Delegation (ENDC/PV.428; CCD/PV.456), by an ad hoc group of experts. The group could include, among others, some of the experts who have already collaborated in producing the SIPRI report and the Report of the Secretary-General of the United Nations.

4. To enable the group of experts to produce, within a relatively short time, a document of use for the purposes indicated above, the Committee, in the Italian Delegation's view, should itself guide the group in its labours, deciding beforehand the lines on which it should work and the specific subjects with which it should deal.

5. On the basis of these considerations the Italian Delegation has thought fit to put forward the following suggestions:

(a) The C.C.D. should set up a group of experts whose task would be to study the technical questions connected with the problem of the control of chemical weapons and to draw up a report thereon which would serve as a background document for the Committee in its work.

(b) The C.C.D. should itself, as a preliminary step, single out the basic subjects which need to be clarified having recourse to expert opinion (for example, it could ask for a study of the possibility of control over the production of chemical agents used solely for warlike purposes, or again it could ask for the study to be extended to substances which can be used for both peaceful and warlike purposes, etc.).

(c) Once the general picture of the subjects to be investigated has been outlined, each Delegation should instruct the appropriate body in its own country to suggest a list of specific technical themes to be developed and studied in more detail (e.g., supposing that the C.C.D. had stated that it thought a technical opinion necessary in regard to the problem of control solely over chemical agents of warfare, the appropriate national bodies in a particular country might propose an investigation of the possibility of instituting controls over the raw materials and intermediates needed for the production of nerve gases and vesicants. In particular, with reference to nerve gases such bodies might propose that the possibility be examined of controlling international trade in phosphorus and the industrial production of organic-phosphorus esters [parathion].)

(d) Each proposal would be transmitted to the group of experts set up by the Committee. The group would have a first meeting to compare and examine the various proposals and then to combine them into a single document to serve as a programme of work.

(e) On the basis of this programme, the group of experts would meet with a view to drawing up a final report. This document should deal in detail with all the problems relating to controls of chemical weapons which are of interest to the Committee, and would constitute the technical background document for further discussions in the C.C.D.

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UNITED STATES OF AMERICA

Working Paper on the Toxin Amendment to the United Kingdom draft Convention for the Prohibition of Biological Methods of Warfare

The United States proposes that toxins be added to the agents whose use is prohibited by Article I of the UK draft Convention (ENDC/255/Rev.1 of 26 August 1969). The U.S. also proposes that the phrase "by infection or infestation" be deleted. Article I would then read as follows:

ARTICLE I

Each of the Parties to the Convention undertakes, insofar as it may not already be committed in that respect under Treaties or other instruments in force prohibiting the use of chemical and biological methods of warfare, never, in any circumstances, by making use for hostile purposes of microbial or other biological agents or toxins causing death, damage or disease to man, other animals, or crops, to engage in biological methods of warfare.

With reference to Article II(a)(i), the United States proposes that the words "or toxins" be inserted after the phrase "microbial or other biological agents" so that the prohibitions and requirements contained in that Article apply to toxins as well.

The first part of Article II, amended, would then read as follows:

ARTICLE II

"Each of the Parties to the Convention undertakes:

(a) not to produce or otherwise acquire, or assist in or permit the production or acquisition of:

(i) microbial or other biological agents or toxins of types and in quantities that have no independent justification for prophylactic or other peaceful purposes; ...."

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CONFERENCE OF THE COMMITTEE ON DISARMAMENT

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The Netherlands

Working Paper concerning United Nations General Assembly resolution 2602 C (XXIV)

A. Prospects for radiological warfare

Two modes of radiological warfare are distinguished in the literature, and also in the United Nations General Assembly resolution: on the one hand the use of nuclear weapons in such a way as to maximize their radioactive effects, on the other hand the use of radioactive agents independently of nuclear explosions.

It is technically possible to manufacture nuclear weapons in such a way that they will cause a maximal amount of fall-out. But it is not probable that a country would deliberately do so, because it would hardly offer distinct military advantages. If nuclear weapons would ever be used, it may be assumed that they will be used with the aim of achieving a decisive effect against an opponent in a short span of time. The short-term lethal effects of a nuclear explosion are caused by blast, heat and initial radiation. Increasing the fall-out would cause harmful effects after weeks, months and even years. Normally, such long-term effects would seem not to be interesting from a military point of view. Moreover, the attacked area would become badly accessible on account of its radioactive contamination. The trend in nuclear weapons technology is going in the direction of cleaner weapons rather than dirtier ones.

The second method of radiological warfare, namely the use of radioactive agents independently of nuclear explosions, is likewise not very plausible.

In order to kill or harm people within a few hours, a radiation dose would be required of at least 1.000 roentgen. But the highly radioactive isotopes one would need for that purpose all have a short or very short half-life. This implies that they cannot be stored for later use. It is true, such isotopes can be produced. For instance, by irradiating uranium in a high-flux reactor one would obtain a considerable amount of highly radioactive material which would remain lethal during a few days. But the transport of this material to the target area would be a very difficult and cumbersome job, in the first place on account of the heavy protective shielding which would be needed for this extremely dangerous material. Large-scale use of such isotopes for so-called strategic purposes is out of the question.

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Whereas the use of highly radioactive materials for causing short-term effects would run into almost unsurmountable practical difficulties, the same does not apply to the use of less radioactive materials which can harm life or health after months or years. For this purpose one might use materials having a long half-life, for instance strontium-90, which has a half-life of thirty years. Such materials are not so difficult to handle and can be obtained relatively easily from the radioactive waste of reactors. But here the same would apply as with regard to the deliberate manufacture of "dirty" nuclear weapons: What would be the military rationale for achieving these long-term harmful effects?

Summing up: judging by the available information possibilities for radiological warfare do exist theoretically, but do not seem to be of much or even of any practical significance.

B. Arms control aspects of radiological warfare

In the light of the foregoing considerations it is difficult to see the practical usefulness of discussing arms control measures related to radiological warfare.

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CONFERENCE OF THE COMMITTEE ON DISARMAMENT

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The Netherlands

Working Paper concerning United Nations General Assembly Resolution 2602 D (XXIV)

A. Survey of possible military applications of laser technology

For the purpose of this survey possible military applications can be divided into three categories.

1. Applications which, by themselves, are not weapons, some of which are already in an advanced stage of development or, in some cases, operational.

First of all, there are applications which have no typical military character but may prove to be equally important for civil and for military purposes. One such application is the use of laser beams for communication purposes. Lasers offer far-reaching possibilities for communications. It is theoretically possible that a great number of messages can be transmitted simultaneously by means of one single laser beam. Another example of laser technology is the construction of optical computers. Both laser communication systems and laser optical computers could be suited for military uses.

Another form of laser technology, which is more directly relevant to warfare, is the laser range-finder. Here lasers can be used instead of radar for measuring distances.

Other military applications comprise the use of laser beams for surveillance and reconnaissance purposes. For instance in the line-scanning camera, and the development of laser devices for navigation systems for missiles and aircraft and possibly, in the future, for submarines and for detection of submarines.

Next we come to applications of lasers which, though not constituting a weapon as such, are very closely connected with the use of weapons, as a valuable aid to increase their effectiveness. This is the laser illuminator or designator; a laser beam is used to designate a target to be attacked by bombs, rockets, missiles or artillery. The designator can be operated by a forward air controller on the ground or from an aircraft. At the same time, a seeking device must be used in the attacking weapon in order to enable it to lock on the designated target and to home in on it. It appears

that this method of laser designation and guidance for air bombardment has already been tested and used in prototype form and proven to increase attack accuracy. Significant increases in accuracy would provide economies in the operation of weapon systems. This development of laser technology, therefore, offers both military and financial advantages.

2. Direct use of lasers as weapons. In this instance the heat of a laser beam is used to destroy a target. It is now already possible to pierce and to cut objects by means of laser beams at a distance of several yards. For use as weapons it would be necessary to achieve such effects at much larger distances. A number of difficult technological problems are yet to be solved.

Among the future largely tactical applications for which laser weapons appear to be conceivable are:

-- defence of naval vessels against low-flying cruise missiles;
-- defence against low-flying targets at forward air bases;
-- defence against tanks on the battlefield;
-- defence against optically guided weapons like optical or infrared missiles, and countermeasures against a host of night vision, infrared and photograph surveillance devices.

An even more remote possibility might be the use of laser weapons for ballistic missile defence. The laser could offer some potential advantages over present A.B.M. systems. Because laser beams travel at the speed of light, the defence could have more time to detect, track, and intercept incoming missiles. Further, a laser A.B.M. weapon would not, itself, produce fall-out. On the other hand, the practical difficulties in developing this type of weapon are likely to be much greater than those of the close-range weapons discussed above. Generating and directing the large amounts of energy, aiming the laser beam, and transmitting it to the target are very difficult technical problems. Further, such a weapon system depends upon the transmission of optical energy and would, therefore, be severely limited for use on cloudy days or in the presence of precipitation.

It has also been speculated that lasers might conceivably be used as weapons of mass destruction in outer space. In addition to certain of the limitations described above, there are inherent characteristics of the laser, notably its narrow beam width and its short effective range, which would militate against its use as a

weapon of mass destruction. In the unlikely event that such a weapon were developed, it should be noted that the Outer Space Treaty already prohibits stationing weapons of mass destruction in outer space.

3. Lastly, a third category of potential military laser technology has recently been referred to in the press. This is the possible use of lasers, instead of fissionable materials, to set off thermonuclear weapons. For that purpose, a laser device which could produce an incredibly high temperature during an incredibly short time would be required. Moreover, such a device would have to be of such moderate dimensions that it could be included in a warhead or bomb. Again, a number of extremely difficult problems would appear to require solution before this type of weapon could be developed. In any event, were such a weapon to be developed, articles I and II of the N.P.T. would continue to apply to the thermonuclear weapons involved.

B. Arms control problems in connexion with the military application of laser technology

With respect to the first category, i.e. applications of laser technology for non-weapon military purposes, it would not seem fruitful to consider the possibility of restrictive measures. It is true that such applications as the laser designator can have an important impact on the conduct of military operations, but it is unlikely that agreement could be reached on a ban or restrictions on devices that are not weapons.

As to the second category, i.e. laser weapons, it would perhaps seem rather premature to consider the possibility of any arms control ban. This is because it is not clear at this stage, whether independent laser weapons systems are a practical and significant possibility.

With respect to the third category, the laser device for exploding a thermonulcear weapon, it has already been pointed out that a number of extremely difficult problems would appear to require solution before this type of weapon could be developed and that articles I and II of the N.P.T. would be applicable to such weapons if developed.

Accordingly, the highly speculative character of the conceivable military applications mentioned in the preceding paragraphs does not seem to substantiate the need for arms control consideration at this time. On the other hand, it seems appropriate to follow attentively further developments in the field of military applications of laser technology with a view to possible future arms control discussion.

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CONFERENCE OF THE COMMITTEE ON DISARMAMENT

UNITED STATES OF AMERICA

Working Paper Comparing Nerve Agent Facilities and Civilian Chemical Production Facilities

1. A working paper submitted by the United States delegation on March 16, 1970 (CCD 283) described the complex relationship between the production of chemicals for peaceful purposes by commercial chemical industries and the production of chemical agents for war. Another question related to a comprehensive ban on chemical weapons and also requiring further study is the extent of the external similarity between plants producing chemical weapons and plants producing industrial and commercial chemical products. In this paper the question is examined with respect to the production of nerve agents.

2. The chemical processing industry encompasses the conversion of various chemical raw materials into usable products of all descriptions. Chemical process plants through-out the world range in production rate from a few hundred pounds to several million pounds of finished product a year, and in area from a few thousand square feet to several thousand acres. The production of chemical nerve agents involves a chemical process in which the production facilities and equipment utilized are similar to the equipment and processes used by a major segment of the world chemical industry. With the advent of highly complex, inter-related chemical complexes, it is also possible that a wide variety of chemical products, including nerve agents, could be produced within a single chemical complex.

3. The US has undertaken as a part of its research programme to examine whether it would be possible by "off-site observation," either from the air or from the ground, to determine whether a particular chemical processing facility or complex was producing, or was capable of producing, lethal nerve agents. Three United States chemical processing plants that are similar in size and general appearance were examined by external inspection. The first of these plants is a cryogenic (low-temperature) natural-gas processing plant; the second is a high-energy fuel facility; and the third (the Newport Chemical Plant), is a VX nerve-agent production facility. The three plants were examined on the basis of general external appearance, e.g. raw-material input, storage facilities, consumption of utilities, and waste disposal, and more specifically on the basis of process equipment and safety features.

4. Raw Material Input - With respect to rail and truck deliveries, it was concluded that aerial observation cannot determine what materials are being supplied to the facility. Moreover, since many of the same basic raw materials used in producing nerve agents, e.g., elemental phosphorus, chlorine, and various petrochemicals, are widely used in commercial production, the identification of some deliveries, even if possible, would not in itself indicate that nerve agents, rather than plasticizers or pesticides, were being produced in the plant. In fact, observation of the containers used in shipping might not even indicate in a general way which of hundreds of chemicals or gases were being transported to the plant. (See paragraph 5 below).

5. Storage Facilities - The raw materials and the intermediate and end products commonly stored in the chemical process industry can be in solid, liquid, or gaseous forms. In all three forms materials can be stored in bulk or in unit containers, outdoors or under shelter. Unit containers are indistinguishable from facility to facility. Solid bulk materials are stored both outdoors and indoors in piles or in bins or bunkers. The bulk storage of all types of liquid materials is, of course, generally carried out in some form of tank, vertical, horizontal, rectangular, or spherical in shape. Tanks are constructed of metal, wood or concrete, and their storage capacity can range from 200 to 1 million gallons. Liquid materials can also be stored in barrels, kegs, drums, cans or glass containers, generally holding less than 75 gallons. Gases stored in bulk are also usually contained in tanks. The most common types of readily observable containers are the large spherical, cylindrical, or horizontal tanks which are used throughout the chemical industry to hold hundreds of different chemicals and gases. These same kinds of containers are also used in nerve agent production.

6. Utilities - The utilities requirements for nerve-agent production are not greatly different from those of regular chemical operations. Electrical power may be required in greater than normal amounts but not to a degree which is unique. This requirement and the more normal water requirement could affect the location of a plant. The availability of large amounts of these utilities to a plant would not, however, be a particular indicator of nerve-agent production since location of industrial chemical facilities near ample electrical and water supplies is common practice.

7. Wastes - The nontoxic wastes of a nerve-agent plant would be similar to those produced by some industrial chemical plants. On the other hand, the chemical waste from the final unit processes for nerve-agent production requires neutralization and

detoxification before it enters the final waste disposal system. Analysis of disposed materials might provide some indication of nerve-agent production, but this could not be done by off-site observation; rather on-site sampling with extremely sensitive instruments would be required. Disposal of toxic wastes is not, of course, a problem peculiar to nerve-agent manufacture.

8. Process Equipment - There are many basic types of chemical processing equipment used for the production of both nerve agents and industrial chemicals, and these basic types can often be converted from the manufacture of one chemical to another, with varying degrees of ease. While this equipment can often be readily observed from outside the plant, very little can be determined about its function or rate of operation.

a. Distillation equipment - Distillation is one of the fundamental processes used to separate a specific chemical or group of chemicals from a mixture. Separation is accomplished in what are generally referred to as distillation columns. These are vertical, cylindrical vessels whose height is usually much greater than their diameter. They range in size from less than 1 foot in diameter and 10 feet in height to more than 15 feet in diameter and 300 feet in height. It is not possible to identify by outside observation the processes taking place within the column. In many chemical plants, distillation columns, like other pieces of equipment, are frequently used in processes other than the one for which they were originally designed.

b. Furnaces - Furnaces are one of the principal components of chemical processing facilities. These industrial furnaces are found in a great variety of sizes and designs, and there is no particular type which would be characteristic of nerve-agent plants.

c. Reactors - A reactor is the processing vessel in which chemical reactions take place. Reactors of all shapes, sizes and configurations are used in the chemical industry, depending upon the specific process in which they are to be used. Some reactors differ only slightly from small storage tanks and small heat exchangers. Reactors can differ substantially in size and shape even though they are designed for similar processes. Again, there is no shape or other characteristic which is unique to nerve-agent production.

d. Scrubbers - There is a rather large variety of equipment generally referred to as scrubbers for the separation of solids, liquids, or specific gases from air or from a gas stream by using water to scrub out the unwanted materials. These scrubbers are

vertical, cylindrical vessels with a relatively large height-to-diameter ratio. The size of the scrubber depends on the amount of air that must be treated. External observation does not reveal the materials that are being treated within the scrubber, and almost any size or shape might be used in a nerve-agent plant.

e. Flare Stacks - These are tall thin towers, up to several hundred of feet high, containing at their centres pipes which carry waste gases to the top where they are burned in the atmosphere. Although flare stacks are highly visible, their appearance would provide no means of distinguishing one plant from another.

9. Safety - Because of the highly lethal nature of the agents being produced, a nerve-agent plant requires special safety measures. In particular, the containment of toxic chemicals requires rigid control of plant air. Air coming out of the toxic process area would need to be scrubbed to remove any toxic materials, and precautions would need to be taken to prevent any air from flowing out of the toxic process area into the non-toxic operating areas. Access between the toxic and non-toxic areas would require special controls such as airlocks. Personnel entering the toxic process area would have to wear masks and protective clothing. Such features, however, would not be observable from outside the plant, since they all pertain to operations within closed structures.

10. Summary - Our research indicates that the problem of identification of nerve-agent production facilities cannot be solved by off-site observation. Chemical process facilities are to be found in numerous locations throughout the world which contain many of the same raw materials, processes, operations, equipment, and support installations as those required to produce nerve agents.